Innovations

The Use of Electronic Communications in Environmental Health Research

The variety and scope of data on environmental health available electronically can easily daunt the most intrepid researcher. The information available ranges from Census Bureau data to anecdotal information to peer-reviewed articles and may take any form from raw data to casual opinions to the observations of world experts. Yet each type and form of data is of value depending on the goals of the environmental health professional—whether to gather data, identify trends, or collaborate with a colleague halfway around the world. There are four types of on-line information systems (electronic bulletin boards, commercial on-line services, commercial databases, and distributed networks), each with distinct benefits to the environmental health professional.

Electronic Bulletin Board Systems

The electronic bulletin board system (BBS) is the least expensive on-line information resource: some BBSs only cost the price of a local telephone call for connection. The environmental health information available via BBSs ranges from incidental information from public postings of electronic mail (E-mail) to electronic reprints of articles from BBSs such as CLU-IN (Cleanup Information Bulletin Board), which is sponsored by the U.S. Environmental Protection Agency.

Electronic bulletin board systems began in 1978 when Ward Christensen and Randy Suess wrote CBBS (Computer Bulletin Board System). Growth has expanded rapidly. The *Wall Street Journal* recently estimated the number of active BBSs in the world at 77,000 (40,000 in the USA alone). The number of BBSs is hard to fix because of the speed with which they are created. It is estimated that by the year 2000, there will be between 15 and 20 million BBS users in the USA.

Electronic bulletin board systems usually contain three sections: one for bulletins and other notices prepared by the system operator, another for E-mail (sending and receiving messages from other users), and a third for files that can be downloaded by users from the BBS to their own computers. An environmental health professional might log to this BBS to gather anecdotal information about current topics such as public perception of the health risks posed by electric power lines or the emergence of possible trends in concerns about environmental health issues. A typical BBS is MNS, an electronic news magazine. Although certain users are granted free access, MNS charges $35 per year. It offers 600 megabytes of public domain software for downloading, and discussions of environmental issues predominate.

The EPA operates a number of BBSs. The CLU-IN includes citations and summaries of EPA *Federal Register* notices, *Commerce Business Daily* procurement and contract award announcements on hazardous waste, solid waste, and underground storage tank remediation, publications on Superfund, documents in the EPA library, and news of meetings, conferences, and site demonstrations. There are also announcements about environmental education software available from the EPA and references to other systems, such as the Hazardous Waste Information Exchange (HMIX) BBS. Available on-line for downloading from CLU-IN is a well-written manual, *OSWER Technology Transfer Electronic Bulletin Board Users Manual*, which introduces the dynamics of BBSs.

Commercial On-line Services

Commercial on-line (or host computer) services offer the full scope of electronic information services, including BBS-type special interest groups (also called forums or roundtables), on-line research and retrieval, E-mail, limited access to the Internet, and ancillary services such as automated article retrieval, stock market quotations, on-line encyclopedias, and real-time conferences using E-mail. Companies such as CompuServe Information Service, GEnie (General Electric Network for Information Exchange), and America Online provide commercial on-line services.

All commercial on-line services charge a fee, depending on the level of service, access speed, and method and use of value-added products, such as commercial databases. These services are growing rapidly: CompuServe has more than 1 million subscribers, GEnie more than 250,000, and America Online has about 200,000. According to the *U.S. Industrial Outlook*, published by the U.S. Department of Commerce, electronic information services generated $12 billion in revenues in 1992. The Department of Commerce estimates that there are currently more than 3 million subscribers to on-line consumer information services.

Each commercial on-line service is an excellent source for gathering information, keeping abreast of developments in specific fields, and communicating with colleagues. Each service has unique features which usually determine the choice of vendor. For example, America Online caters to people interested in environmental issues. Its forum includes "The Front Desk," where users describe their interests and enter into general discussion, "The Biosphere," for public messages about environmental issues concerning the air and atmosphere, "Mother Earth," a message area for discussion of the earth and issues from acid rain to zoological extinction, and "Environchat," for conducting interviews with well-known environmentalists and scientists. Other areas include the "Water Cooler," for debating environmental issues, the "Litter Free Library" for uploading and downloading programs and educational resources, and the "Environmental News Archives" from the Environment News Service.

Using CompuServe, an environmental health professional could observe the current interests of journalists via "JForum," a special interest group that caters to all segments of the media. Researchers seeking coverage of their research could review the profiles of JForum members to see if any of the members would be interested in writing a story on their work. A new service lets journalists send article queries to a central source for redistribution to public information officers at more than 100 academic institutions throughout the country. Those institutions interested reply directly to the journalist. A query for information on environmental health experts yielded 10 replies in 3 days from geographic locations ranging from New Mexico to Israel. The query also yielded information about the *GreenDisk Paperless Environmental Journal*, which documents environmental research by scanning sources on topics such as renewable energy, marine mammal protection, and toxic waste disposal. The journal is only available on diskette or on-line. Such services are well-documented in numerous publications. Software developers have produced programs that allow easy access to the systems with a savings in on-line costs.

Commercial Databases

Commercial database services, such as Lexis/Nexis and Knowledge Index, offer a host of databases from which to gather

information on environmental health. Database services such as Dialog Information Services offer a virtual warehouse of files covering every field imaginable, some produced by the service and some licensed from producers and suppliers. These services carry an annual fee as well as on-line charges, which range from $15 per hour to more than $300 per hour. Commercial database services also offer off-line printing and distribution of documents as well as document delivery for files that are not full text. Dialog Information Services has an extensive program of user seminars, many of which are free.

According to the *Directory of Online Databases*, some 5026 databases are publicly available for on-line searching. Databases related to environmental health include ENSR Health Sciences, Envirofate, Enviroliner, Environment News Service Data Base, Environment Week, Environmental Bibliography, Environmental Health News, Environmental Information and Documentation System/Federal Environmental Agency/Germany, Environmental Information Division/ National Institute for Environmental Studies/ Environment Agency/Japan, Environmental Information Network Inc., the Environmental Mutagen Information Service and Environmental Teratology Information. In-depth documentation on database services is available from the vendors, and users receive updates through newsletters and file descriptions.

Knowledge Index is an off-peak service (accessible only from 6 PM to 5 AM) that charges a flat fee of $24 per connect hour. It has a database on pollution abstracts from 1970 to the present that is produced by Cambridge Abstracts. Another excellent database for environmental health professionals is the Federal Assistance Programs Retrieval System (FAPRS), produced by the U.S. General Services Administration. This database contains descriptions of 1288 assistance programs administered by 51 federal agencies to fund research and programs for federal, state, and local governments, private institutions, and individuals. The cost is $24 per connect hour with access at 9600 bits per second; there are no startup fees, and the user can dial in through a toll-free number.

A quick search of FAPRS identified several grant programs in environmental health. Each citation is accompanied by an extensive program description that notes the agency involved, authorization, objectives, types of assistance, uses and use restrictions, eligibility requirements, application and award process, assistance considerations, financial information, regulations, guidelines and literature, and information contacts.

Distributed Networks

The final category of on-line information systems is distributed networks, including Internet, which offer E-mail to sites across the globe, file transfer protocol (uploading and downloading files), Telenet (browsing of BBS-type systems), mailing lists (special interest-group mail distribution), and news groups dedicated to different topics.

Internet is one of the most timely, interesting, and exciting communications channels for environmental health professionals. Such networks let professionals communicate inexpensively across global boundaries, for example, to collaborate on a research article. Internet was described in the *Directory of Online Databases* as ". . .an internetwork of many networks . . ., connected through gateways, and sharing common name and address spaces. It exists to facilitate sharing of resources at participating organizations (which include government agencies, educational institutions, and private corporations) and collaboration among researchers." In other words, a group of computers networked at one site allows users to communicate with those at another site across the globe.

Started in the late 1960s as ARPA Internet, the network has experienced phenomenal growth, especially during the last few years. Today, Internet caters to millions of users on almost 1 million host computers worldwide. Part of the reason for its growth is the increased computer sophistication of users outside the disciplines of computer science and engineering. Also contributing to Internet's growth is its accessibility through commercial on-line services. In fact, Internet connections now allow individuals complete access to all Internet services for a reasonable fee. One such service is The World, headquartered in Boston. For researchers interested in the environment, EcoNet, started in 1987 and based in San Francisco, allows limited access to Internet and offers E-mail, electronic conferences, a user directory, and a number of databases on the environment. Two electronic conferences, "en.health" and "en.toxics," cover environmental health issues.

The USENET is a collection of hundreds of discussion groups, many distributed worldwide. Similar to electronic conferences, these news groups feature a free and open exchange of E-mail. In the environmental health area are "ca.environment" (environmental concerns in California), "uiuc.safety" (environmental health and safety forum), "umiami.environment" (discussions on the south Florida environment), "clari.tw.environment" (en-

vironmental news, hazardous waste, forests; moderated), "fj.soc.environment" (natural environment and society), "nz.soc.green" (environmental issues), "alt.save.the.earth" (environmentalist causes), "bit.listserv.envbeh-l" (forum on environment and human behavior), "sci.environment" (discussions about the environment and ecology), and "talk.environment" (discussions about the state of the environment and recommended actions). Restrictions apply in these news groups; for instance, most do not allow commercial messages, and special commands are required to read and send messages. To keep up with developments in distributed networks, environmental health researchers should subscribe to "new-list," an Internet mailing list to keep users informed of new lists.

On-line information systems are fast becoming a critical part of the research enterprise, and understanding how they work and what they offer will assist researchers in performing their work efficiently. The growth of on-line services is likely to accelerate as businesses seek to exploit the projected 15-20% annual increase in revenues. With the advent of the electronic peer-reviewed journal, researchers cannot afford to ignore this medium.

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